total of 13,996 thunderstorms reported for the 13-year period, only 940 or 6.1 percent were recorded as having been attended by moderately heavy hail. Considering only the 6 months of the year we find the percent of reported thunderstorms accompanied by hail was highest in April and May, and lowest in September.

TABLE 1.—*The total number and percent of thunderstorms attended by hail for the years 1924–36 inclusive*

[Source of data: United States Weather Bureau, Lincoln, Nebr.]

Month	Total number for 13-year period	Total number accompanied by hail	Percentage accompanied by hail
April	1,204	120	9.9
May	1,792	201	11.2
June	4,780	269	5.6
July	2,359	142	6.0
August	2,636	145	5.5
September	1,225	63	5.1
Total	13,996	940	6.1

More hailstorms were formed in frontal thunderstorms than in any other type. Fifty-four and a half percent of the hailstorms occurred in the frontal thunderstorms, 42.4 percent in the heat type, and only 3.1 percent in or near the center of an area of high pressure.

TABLE 2.—*The percent of thunderstorms attended by hail, in relation to the different types of pressure areas*

[Source of data: United States Weather Bureau, Lincoln, Nebr.]

Month	Percent in warm sector of low	Percent of frontal type	Percent in center of high
April	2.2	7.4	0.2
May	10.0	11.7	1.1
June	10.0	17.3	.5
July	7.0	5.1	.8
August	11.0	9.9	.5
September	2.2	3.1	.0
Total	42.4	54.5	3.1

The hours during which the largest number of hailstorms occurred show little relation to the hours of greatest precipitation. Sixty-one percent of the hailstorms took place between the hours of 2 p. m. and 7 p. m., and only 21 percent occurred between 8 p. m. and 6 a. m., whereas during the period 1905–23 at Lincoln, about 34 percent of the total amount of rain fell from 6 a. m. to 6 p. m. and about 66 percent from 6 p. m. to 6 a. m.[1] It is generally accepted that the major portion of summertime rainfall comes as the result of thunderstorms. Kincer[2] found that in a small area centered roughly over eastern Nebraska, 65 percent of the summer rain falls between the hours of 8 p. m. and 8 a. m. With the exception of a small area in southern Arizona the area in Nebraska experienced the highest summer nighttime precipitation in the United States.

TABLE 3.—*The number and percent of hailstorms which occurred during the 24 hours of the day*

[Source of data: United States Weather Bureau, Lincoln, Nebr.]

Hour	Number	Percent	Hour	Number	Percent
6–10 a. m.	9	2.3	5–6 p. m.	44	11.3
10–12 noon	7	1.8	6–7 p. m.	51	13.4
12–1 p. m.	4	1.0	7–8 p. m.	36	9.4
1–2 p. m.	9	2.3	8–9 p. m.	20	5.2
2–3 p. m.	26	6.8	9–10 p. m.	25	6.5
3–4 p. m.	53	13.9	10–12 midnight	18	4.7
4–5 p. m.	58	15.0	12–6 a. m.	20	5.2

Whether more afternoon thunderstorms were actually attended by hail, or whether numerous nighttime hailstorms were not reported, must remain a matter of conjecture, however, until longer and more complete records are available.

Of the 404 hailstorms for which data are available, 78.8 percent came from some westerly direction. The largest number coming from any one direction was 173 or 42.8 percent, from the northwest. The smallest number, 5 or only 1.2 percent, was reported from the east.

TABLE 4.—*Direction of movement of hailstorms in Nebraska, 1923–36, inclusive*

[Source of data: United States Weather Bureau, Lincoln, Nebr.]

Directions from which hailstorms came	Number of storms	Percent of total number of storms	Directions from which hailstorms came	Number of storms	Percent of total number of storms
North	28	6.9	South	5	1.2
Northwest	173	42.8	Southeast	18	4.4
West	63	15.6	East	6	1.5
Southwest	82	20.4	Northeast	29	7.1

[1] Carter, Harry G. Variation in hourly rainfall at Lincoln, Nebr. MO. WEA. REV., April 1924, 52: 208–212.
[2] Kincer, Jos. B. Daytime and nighttime precipitation and their economic significance. MO. WEA. REV., Nov., 1916, 44: 628–633.

THUNDERSTORM FREQUENCIES FOR 6-HOUR PERIODS AT MILES CITY, MONT.

By LOUIS R. JURWITZ

[Weather Bureau, Miles City, Mont., January 1937]

Miles City is about 200 miles east-northeast of the Continental Divide which runs through northwestern Wyoming. The city is on the Yellowstone River, approximately 150 miles from where it enters the Missouri River, and at the junction of the Tongue and the Yellowstone Rivers. The elevation of the Weather Bureau station at Miles City is 2,351 feet. The surrounding region to the north and west is flat with low, rolling swells; to the east, south, and southwest the country is more rugged with hills rising to an elevation of 500 to 800 feet above the valley floor.

Vegetation is sparse except on the hills to the east which are moderately covered with scattered stands of pine. The hills to the south and southwest are bare and of a "badland" character favoring convectional thunderstorms. Fully 75 percent of the thunderstorms which occur at the station have their origin to the south and southwest while the remainder of the convectional type storms move into the valley from the hills that lie to the east.

Thunderstorms are in general of moderate intensity, and as a rule last from 2 to 6 hours, with occasional excessive precipitation and moderate hail.

Figure 1 shows that the majority of thunderstorms occur during June; 94 out of a total of 290 storms recorded in the period 1923–35 occurred during that month. Thunderstorm frequency remains relatively high during the 6-hour period from 6 p. m. to midnight during July and August due to the high evening temperatures prevalent in those 2 months, whereas it falls off rapidly during June. In June, 42 thunderstorms, or 45 percent of the total recorded for that month, occurred between noon and 6 p. m., while for the period from 6 p. m. to midnight a decrease to 34, or 36 percent of the total, is shown.

In July and August, the 6-hour period 6 p. m. to midnight had a higher frequency than the noon to 6 p. m. period. The noon to 6 p. m. period for July had 33 percent of the total number of storms, while the 6 p. m. to midnight period had 36 percent. A greater divergence is noted for August, with the noon to 6 p. m. period having only 20 percent of the total and the 6 p. m. to midnight period 45 percent.

The graphs of the number of thunderstorms recorded for the entire period 1923–35 show for those occurring between noon and 6 p. m. nearly symmetrical ascent and descent on either side of a peak in June, and for those between 6 p. m. and midnight a relatively high peak maintained from June through August.

The 6-hour period from 6 p. m. to midnight shows the highest percentage of thunderstorms, with 37 percent of the total of 290 storms that were recorded; the noon-to-6 p. m. period is a close second, with 35 percent; and the two 6-hour periods from midnight to 6 a. m., and 6 a. m. to noon, show 10 percent each. The times of beginning of 8 percent of the thunderstorms are unknown.

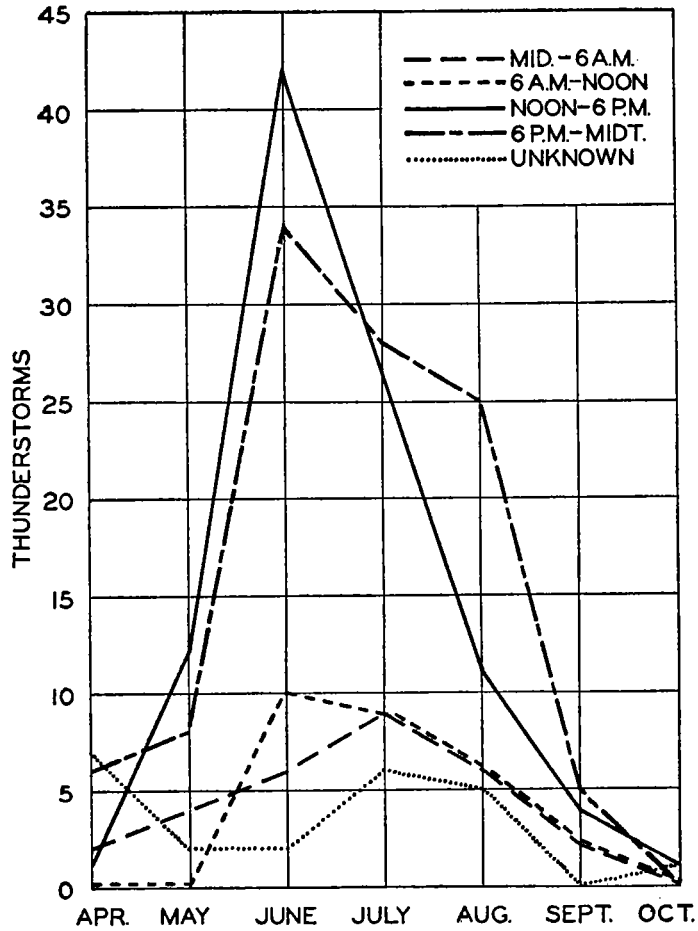

FIGURE 1.—Frequencies of thunderstorms recorded at Miles City, in 6-hour periods, 1923 to 1935, inclusive

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[RICHMOND T. ZOCH, *in Charge of Library*]

By AMY D. PUTNAM

RECENT ADDITIONS

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